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WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1) or any other requirements, or both, which may be applicable to the user.

Installation, operation, and maintenance should only be performed by qualified personnel.

TM-111925

VOLUME 2 -- SERVICE MANUAL

626-PA-6020

BROADBAND RADIO FREQUENCY (RF) MONITOR

1 June 1987

See opposite side relative to proprietary rights.

Note: Refer to Volume 1 (Operator's Manual) of TM-111925 for installation and operation instructions.

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DRANETZ

DRANETZ TECHNOLOGIES, INC.
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VOLUME 2
SERVICE MANUAL

626-PA-6020 BROADBAND RADIO FREQUENCY (RF) MONITOR

SECTION IV
THEORY OF OPERATION

4.1 SCOPE AND INTRODUCTION

Volume 2 of TM-111925 provides the service, calibration, and maintenance instructions for the 626-PA-6020 Broadband Radio Frequency (RF) Monitor plug-in module. For simplicity, it's referred to as the 6020 plug-in.

Volume 2 is a continuation of Volume 1, the Operator's manual. Volume 1 contains sections I, II, and III which describe the installation, operation, and operational test instructions for the plug-in. Volume 2 has four sections: (IV) THEORY OF OPERATION, (V) MAINTENANCE AND CALIBRATION, (VI) REPLACEABLE PARTS LIST, and (VI) SCHEMATICS AND GENERAL ASSEMBLY.

4.2 DESCRIPTION OF OPERATION

The 6020 plug-in measures the electrical field around its antenna unit using the voltage gradient between the antenna unit and ground. The voltage magnitude is directly proportional to the applied electrical field.

To achieve broadband performance, the antenna is very short with respect to the wavelengths it measures. The antenna's monopole shape creates omnidirectional responses to vertically polarized fields. Input voltage is amplified and passed through an envelope detector to filter out high frequency components. This leaves a waveform with a bandwidth extending to 1 MHz. This waveform is then transmitted to the plug-in through a shielded cable.

The conditioned signal received by the plug-in is sent to an integrator, peak detector, and threshold comparators. Through these circuits the peak field, average field, and peak field duration are determined.

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4.3 BLOCK DIAGRAM

Below is the block diagram of the 6020 plug-in:

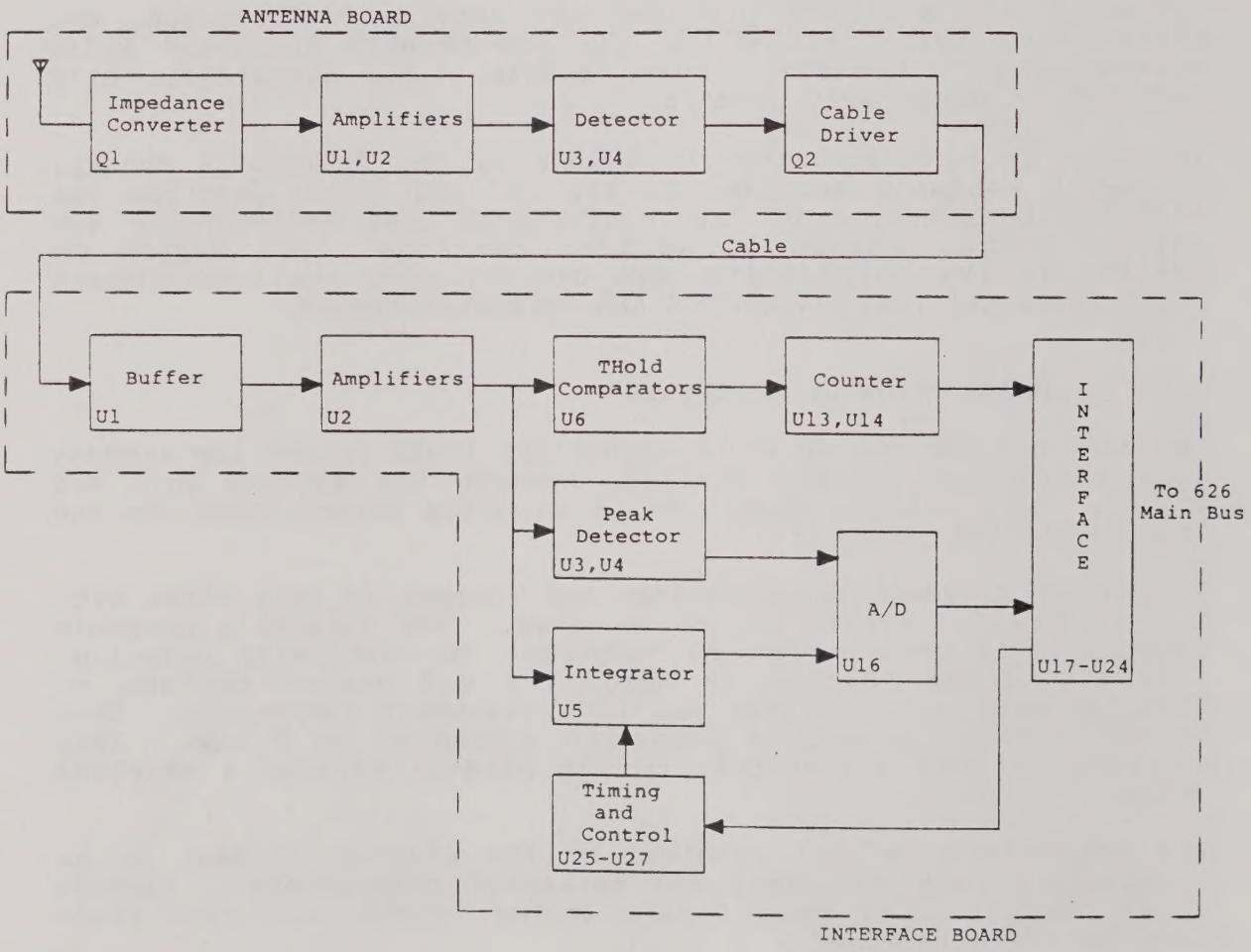

Figure 4-1. Block Diagram of the 6020 Plug-in

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4.3.1 Block Diagram Description

Antenna Board
The voltage between the antenna and ground is applied to the gate of transistor Q1. The transistor functions as an impedance converter, providing high input impedance matching the antenna and low output impedance for subsequent gain stages. The two wideband hybrid amplifiers following Q1 (U1 and U2) increase the signal to a level suitable for the detector (U3 and U4). The detected signal is then fed through an operational amplifier (Q2) that drives a transistor, that drives the cable supplying the signal to the plug-in.

Interface Board
The signal reaches the plug-in through buffer U1. It is then amplified slightly (U2) before heading to the processing circuitry consisting of threshold comparators (U6), peak detectors (U3 and U4), and an integrator (U5).

The threshold comparators are used in conjunction with a counter (U13 and U14) to determine how long the electrical field is out of limits. Peak detectors are used to hold the peak value of the electrical field long enough to be recognized and read by the CPU. The integrator is used to determine a time-averaged value of the electrical field. The output of this integrator is read and then reset every twenty milliseconds (U25, U26, and U27).

Peak detector output is fed to the A/D converter (U16) and its output is latched (U19 and U21) where it can be read by the CPU.

4.4 ANTENNA BOARD - DETAILED DESCRIPTION

Refer to Figure 7-3 for the antenna board assembly; refer to Figure 7-5 for the antenna board schematic.

Transistor Q1 is used as a high-to-low impedance converter. Diodes CR1-CR4 protect GaAs FET Q1 from overloads. The available voltage at the source of Q1 is then amplified by two hybrid R.F. amplifiers (U2 and U3). Once amplified, this signal is fed into the envelope detector (U4). Coupling capacitors C1, C4, and C6 determine the low frequency cutoff point for each of the stages.

The detector output has a bandwidth that extends to 1 MHz which is fed through an operational amplifier (U4) and then to Q2, which drives the cable to the interface board. Potentiometer R9 is used to null the offset from the operational amplifier.

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4.5 INTERFACE BOARD - DETAILED DESCRIPTION

Refer to Figure 7-2 for the interface board assembly; refer to Figure 7-8 for the interface board schematic.

The cable from the antenna board ends at resistor R63. The voltage across this resistor is then passed through a one-pole filter with a 1 MHz cutoff frequency and then on to a buffer amplifier. The signal is then split three ways and conditioned by amplifiers to prepare it for the subsequent circuitry.

There are four comparators (U6) used for threshold crossing information. One of the four is selected by U9 based on the user-selected "burst" sensitivity. The output of U9 then enables a counter (U13 and U14) which runs at a 1-MHz rate. This provides duration information to the CPU.

A two-stage peak detector (U3 and U4) captures and holds the maximum voltage of the short-duration R.F. bursts until being reset (Q1-Q3). The peak detector output is fed to the A/D converter (U16) and its output is latched (U19 and U21) where it can be read by the CPU.

An integrator (U5) is used to determine the average electrical field value over a fixed period of time. The output of this integrator is fed to a track and hold circuit (U5). Every twenty milliseconds, the track and hold is put in the hold mode and the integrator is reset. Integrator timing and control is done with a dual multivibrator (U25) which is triggered at a 50-Hz rate. The sample and hold output is then fed to the A/D converter (U16) for conversion. The output of the A/D converter is then latched (U19 and U21) for reading by the CPU.

Information from the interface board is read by the CPU only after an interrupt request is granted. The 6020 plug-in generates an interrupt request every twenty milliseconds synchronized to the integrator timing. During each interrupt, the peak and average information are both read. The interrupt timing is derived by dividing down the CPU clock (U12).

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SECTION II
MAINTENANCE AND CALIBRATION

5.1 GENERAL

This section contains the maintenance and calibration instructions for the 6020 plug-in. The plug-in should be calibrated every 12 months. You may return it to the factory for calibration after contacting Dranetz Service Corp. for instructions:

Tel. No: (201) 755-7081

TWX No: (710) 997-9553

Telex No: 499-7808

Cable: DRANETZ

You may also calibrate the plug-in on your own if you have the proper equipment. If you decide to do so, carefully follow the instructions of this section.

5.2 MAINTENANCE

Calibrating the 6020 plug-in insures its proper operation. Calibration test procedures are provided for all major plug-in functions. Special test equipment designed for field calibration are listed and step-by-step instructions are provided for their use.

NOTE

Read over the entire Maintenance section of Volume 2 of the Mainframe manual before proceeding further.

5.2.1 Service Warning

WARNING

The following calibration instructions are intended for qualified personnel ONLY. To avoid electrical shock, DO NOT perform any service other than that contained in your Operator's manual unless you are qualified to do so.

DO NOT attempt internal service or adjustment unless another person, capable of rendering aid and resuscitation, is present.

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Read Instructions Carefully

Because of possible shock or fire hazards, DO NOT perform any servicing tasks beyond your qualifications. Your qualifications for performing such tasks should be self-determined.

5.3 REQUIRED TEST EQUIPMENT

Item	Characteristics	Recommended Model
Extender Card		Dranetz P/N 110260
Signal Generator	10 to 1000 MHz	Wavetek 2002A
R.F. Voltmeter		Boonton 9200A
R.F. Power Amp	10 to 1000 MHz, 2 watts minimum	Amplifier Research 5W1000
Frequency Counter	10 to 1000 MHz	Sencore FC71
Multimeter		Fluke Model 8840A
Oscilloscope		Tektronix Model 2245
TEM Cell	DC to 250 MHz	Amplifier Research TC0250

5.4 CALIBRATION PROCEDURE

The next several subsections provide the procedures for calibration.

5.4.1 Plug-in Removal

WARNING

Be sure that the Series 626 Mainframe and all power connected to its modules is turned off.

(1) Loosen the plug-in's top and bottom captive screws.

(2) Carefully slide the plug-in out of the Mainframe and place it on your work bench.

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5.4.2 Extender Card Installation

(1) Slide the extender card into the 6020 plug-in's slot until it's firmly in place.

Note: If the lettering on the extender card is upside down, the card is upside down, therefore, flip it over before inserting.

(2) Attach the 6020 plug-in to the end of the extender card and tighten its captive screws.

Note: Brace the bottom of the plug-in so that the weight of the test equipment does not pull it out of place.

(3) Connect the metal bracket which secures the rear panel of the plug-in to the Series 626 chassis by using an alligator-to-alligator clipped lead.

5.4.3 Calibration

(1) Connect the antenna unit to the rear panel of the plug-in.

(2) Connect a ground lead between the antenna disk and its unit frame.

(3) Turn on the Series 626.

(4) Adjust resistor R9 on the antenna unit board so that the voltage at E1 is between 0 and +3.0 mV.

(5) Turn off the Series 626 and then remove the ground strap.

(6) Place the antenna unit in the TEM cell. Connect the ground strap on the antenna unit to the ground of the TEM cell.

(7) Turn on the Series 626.

(8) Apply a signal of 6.0 volts/meter at 100.0 MHz to the TEM cell.

(9) Adjust resistor R15 on the antenna board so that the voltage at E1 is between 0.84 and 0.89 volts.

(10) Adjust resistor R50 for a reading of 6.0 V/M, $\pm$0.2 V/M.

(11) With the same signal applied, read the voltage at U5-U7. Adjust resistor R28 until the voltage at U4-U7 is within 1% of the voltage at U5-U7.

(12) Reduce the applied field to 1.0 V/M and check that the reading is within specified levels.

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(13) Reduce the R.F. level to 0.5 V/M. Adjust resistor R9 on the antenna board until a data reading of 0.5 V/M is obtained (usually, no more than 0.030V of offset is needed).

(14) Increase the R.F. level to 1.0 V/M. Check that the data reading is 1.0 V/M$\pm$2.0 V/M.

(15) Set the R.F. level to 2.0 V/M. Use the oscilloscope to adjust resistor R5 on the interface until pin 5 of U9 remains continuously "high".

(16) Turn off the CW signal source and remove the antenna unit from the TEM cell.

(17) Turn off all signal sources.

(18) Place the unit in the System Check mode. Check for proper readings (refer to Volume 1, Section III). During the system check, a 1 MHz signal is applied to the antenna unit. The signal is available at E7.

(19) Cover the adjustment holes (R9,R15) with conductive copper or aluminum adhesive tape.

(20) Turn off the Series 626.

(21) Disconnect the antenna unit from the Mainframe and install its plastic cover.

(22) Remove the extender card and reinstall the plug-in.

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SECTION VI
REPLACEABLE PARTS LIST

6.1 GENERAL

The replaceable parts are listed in Table 6-1 which begins on the following page. Contained in the parts list are the description, identification number, reference designation, and manufacturer's code.

6.2 MANUFACTURER'S REFERENCE CODES

The manufacturer's reference codes from Table 6-1 are:

Man. Code	Source
23207	Dranetz Technologies, Inc. 1000 New Durham Road P.O. Box 4019 Edison, NJ 08818-4019 (201) 287-3680
81349	On MIL specifications list. Manufactured to meet military specifications. Available from a variety of suppliers.
70903	Belden Manufacturing Co. Chicago, IL 60644
POMONA	ITT Pomona Electronics 1500 East 9th Street P.O. Box 2767 Pomona, CA 91769

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Table 6-1. Replaceable Parts List

REFERENCE DESIGNATION	PART OR ID NUM.	MAN. CODE	DESCRIPTION
	626-PA-6020 Plug-in MF Assy (LM111925-G1)		
J1	110832-G1	23207	Connector
	626-PA-6020 Plug-in Interface Bd (LM111928-G1)		
C1-C4	104023-G7	23207	Cap Fxd Mica 68pF±2%, 500V
C5	104018-G4	23207	Cap Fxd Mica 120pF±5%, 100V
C6	104018-G3	23207	Cap Fxd Mica 100pF±5%, 100V
C7	104018-G5	23207	Cap Fxd Mica 150pF±5%, 100V
C8,C11,C12	104087-G1	23207	Cap Fxd Flm 0.01uF±10%, 63V
C9	104114-G1	23207	Cap Fxd Flm 0.022uF±5%, 100V
C10	104087-G3	23207	Cap Fxd Flm 0.022uF±10%, 63V
C15,C16,C21 C23,C25-C33	103209-G2	23207	Cap Fxd Cer 0.22uF±20%, 50V
C20,C22,C24	104067-G2	23207	Cap Fxd Tant 22uF±20%, 35V
CR1-CR4	104412-G3	23207	Diode
L1,L2	103580-G1	23207	Ferrite Bead
Q1-Q3	104515	23207	Transistor, Low Noise NPN
R1,R7	RN55C6651F	81349	Res Fxd Flm 6.65K±1%, 1/10W
R2,R3,R6,R46	RN55C1002F	81349	Res Fxd Flm 10K±1%, 1/10W
R4,R27	RN55C5231F	81349	Res Fxd Flm 5.23K±1%, 1/10W
R5,R28	104717-G7	23207	Res Var Comp 20K±10%, 1/2W
R8	RN55C1272F	81349	Res Fxd Flm 12.7K±1%, 1/10W
R9,R47	RN55C6491F	81349	Res Fxd Flm 6.49K±1%, 1/10W
R10	RN55C3921F	81349	Res Fxd Flm 3.92K±1%, 1/10W
R11	RN55C2551F	81349	Res Fxd Flm 2.55K±1%, 1/10W

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Table 6-1. Replaceable Parts List (cont'd)

REFERENCE DESIGNATION	PART OR ID NUM.	MAN. CODE	DESCRIPTION
R12-R19,R45	RCR07GF302J	81349	Res Fxd Comp 3K±5%, 1/4W
R20-R23	RCR07GF304J	81349	Res Fxd Comp 300K±5%, 1/4W
R24,R57,R59,R60	RCR07GF203J	81349	Res Fxd Comp 20K±5%, 1/4W
R29	RN55C1872F	81349	Res Fxd Flm 18.7K±1%, 1/10W
R30,R31,R37	RCR07GF331J	81349	Res Fxd Comp 330-Ohms±5%, 1/4W
R32,R36,R51	RCR07GF222J	81349	Res Fxd Comp 2.2K±5%, 1/4W
R33	RCR07GF821J	81349	Res Fxd Comp, 820-Ohms±5%, 1/4W
R34,R41,R42	RCR07GF107J	81349	Res Fxd Comp 100M±5%, 1/4W
R35	RN55C5621F	81349	Res Fxd Flm 5.62K±1%, 1/10W
R38	RCR07GF202J	81349	Res Fxd Comp 2K±5%, 1/4W
R39,R40,R43	RCR07GF512J	81349	Res Fxd Comp 5.1K±5%, 1/4W
R44	RCR07GF123J	81349	Res Fxd Comp 12K±5%, 1/4W
R48	RN55C1912F	81349	Res Fxd Flm 19.1K±1%, 1/10W
R49	RN55C4533F	81349	Res Fxd Flm 453K±1%, 1/10W
R50	104717-G8	23207	Res Var Comp 100K±10%, 1/2W
R52	RCR07GF273J	81349	Res Fxd Comp 27K±5%, 1/4W
R53	RCR07GF103J	81349	Res Fxd Comp 10K±5%, 1/4W
R58	RCR07GF150J	81349	Res Fxd Comp, 15-Ohms±5%, 1/4W
R61,R62	RN55C9091F	81349	Res Fxd Flm 9.09K±1%, 1/10W
R63	RN55C1000F	81349	Res Fxd Flm, 100-Ohms±1%, 1/10W
R64	RCR07GF102J	81349	Res Fxd Comp 1K±5%, 1/4W

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Table 6-1. Replaceable Parts List (cont'd)

REFERENCE DESIGNATION	PART OR ID NUM.	MAN. CODE	DESCRIPTION
R65	RN55C6191F	81349	Res Fxd Flm 6.19K±1%, 1/10W
R66	RN55C3831F	81349	Res Fxd Flm 3.83K±1%, 1/10W
U1-U5	104247-G2	23207	I.C. Dual Op Amp
U6	104241-G2	23207	I.C. Quad Comparator
U7	104362	23207	I.C. Quad Switch
U9	104392-G8	23207	I.C. Dual 1 of 4 Decoder
U11,U23,U32	104201-G1	23207	I.C. Dual "D" Flip-Flop
U12	104203-G4	23207	I.C. Binary Control/Div Osc
U13,U14	104204-G7	23207	I.C. 8-Bit Binary Counter
U15	104217-G2	23207	I.C. Dual Binary Counter
U16	104365	23207	I.C. 10-Bit A/D Converter
U17-U19,U22,U33	104290-G4	23207	I.C. Latch, 8-Bit
U20,U21	104225-G7	23207	I.C. Octal Latch, Tri-State
U24	104290-G3	23207	I.C. Octal XVCR, Tri-State
U25	104231-G5	23207	I.C. Octal Dual Multvibrator
U26,U27	104290-G2	23207	I.C. 3-to-8 Decoder
U28	104200-G3	23207	I.C. Quad NAND Gate
U29	104204-G4	23207	I.C. Quad AND Gate
U31	104203-G2	23207	I.C. Inverting Hex Buffer
U34	Program Listing 105909	23207	I.C. 4K EPROM
Used @ U34	110749-G7	23027	I.C. Socket, 24-Pin
Used @ U16	110749-G4	23207	I.C. Socket, 18-Pin

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Table 6-1. Replaceable Parts List (cont'd)

REFERENCE DESIGNATION	PART OR ID NUM.	MAN. CODE	DESCRIPTION
	Antenna Board (LM111934-G1)		
C1-C7	104131-G1	23207	Cap Fxd Cer 0.022uF±10%, 50V
CR1,CR2	102899	23207	Diode, Shottky
CR3	104403-G7	23207	Diode, Zener 5.6V
CR4	104404-G5	23207	Diode, Zener 9.1V
L1,L2	103580-G1	23207	Ferrite Bead
Q1	104556-G1	23207	Transistor, Gasfet Dual Gate
Q2	104515	23207	Transistor, General Purpose NPN SIL
R1	104747-G1	23207	Res Fxd Flm 1.0M±1%, 1/10W
R3	104747-G2	23207	Res Fxd Flm 249±1%, 1/10W
R4,R5	RN55C1073F	81349	Res Fxd Flm 107K±1%, 1/10W
R6-R8	RN55C1001F	81349	Res Fxd Flm 1.0K±1%, 1/10W
R9	104717-G9	23207	Res Var 10K, 1/2W
R10	RN55C6650F	81349	Res Fxd Flm 665K±1%, 1/10W
R11	RN55C2001F	81349	Res Fxd Flm 2.0K±1%, 1/10W
R12	RCR07GF510J	81349	Res Fxd Comp, 51-Ohms±5%, 1/4W
R13	RCR07GF332J	81349	Res Fxd Comp 3.3K±5%, 1/4W
R14	104747-G3	23207	Res Fxd Flm 1.8K±5%, 1/10W
R15	104717-G1	23207	Res Var, 500-Ohms±10%, 1/2W
U1	104378-G3	23207	Amp Hybrid, +0DBM, 1000MHz
U2	104378-G1	23207	Amp Hybrid, +6DBM, 1000MHz
U3	104379-G1	23207	Detector, Hybrid, 1000MHz
U4	104247-G1	23207	I.C. Op Amp

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Table 6-1. Replaceable Parts List (cont'd)

REFERENCE DESIGNATION	PART OR ID NUM.	MAN. CODE	DESCRIPTION
	Antenna Unit (LM111926-G1)		
--	1166-4-0	POMONA	Ground Lead
C1,C2	103209-G4	23207	Cap Fxd Cer 0.047uF±20%, 100V
	Antenna Assembly (LM111940-G1)		
L1	104668-G1	23207	Ferrite Bead
L2	104668-G2	23207	Ferrite Bead
	Antenna Unit Cable (LM111927-G1)		
P1	110832-G2	23207	Connector
--	9730	70903	Cable, 24 AWG, 3-Pair Shielded

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SCHEMATICS AND GENERAL ASSEMBLY

7.1 GENERAL

The following pages contain the schematics and assembly drawings for the interface board, antenna board, and antenna unit.

7.2 SCHEMATICS AND ASSEMBLIES

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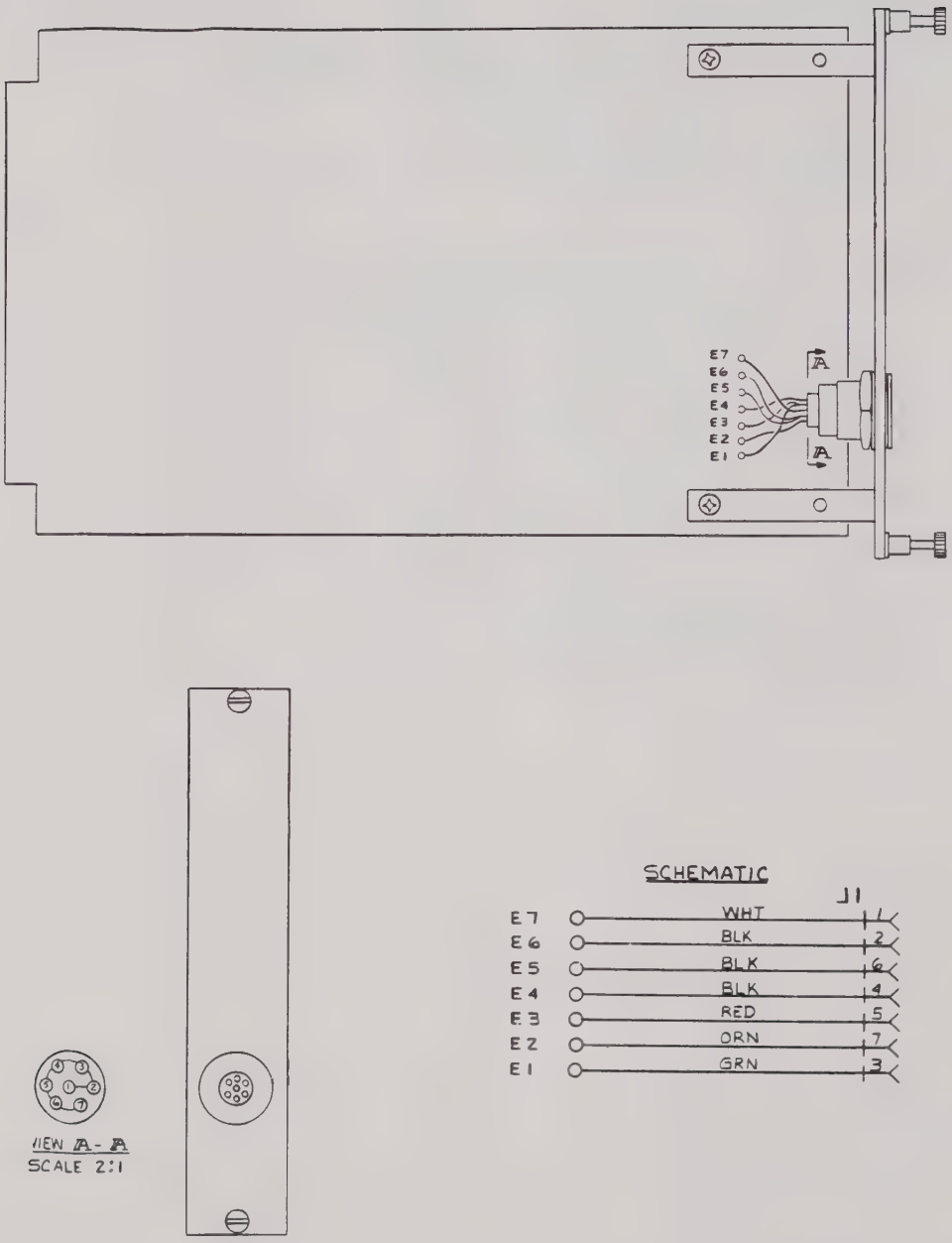

Figure 7-1. 626-PA-6020 Mainframe Assembly
111925-G1 (rev B)

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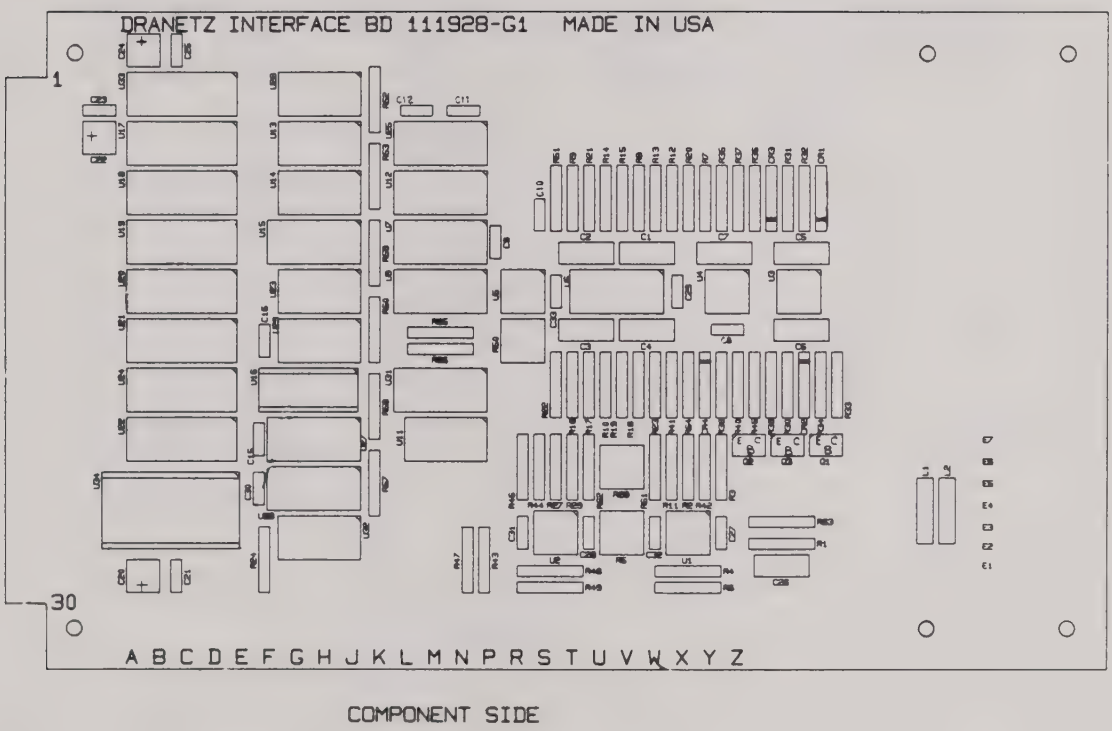

Figure 7-2. Interface Board Assembly
111928-G1 (rev B)

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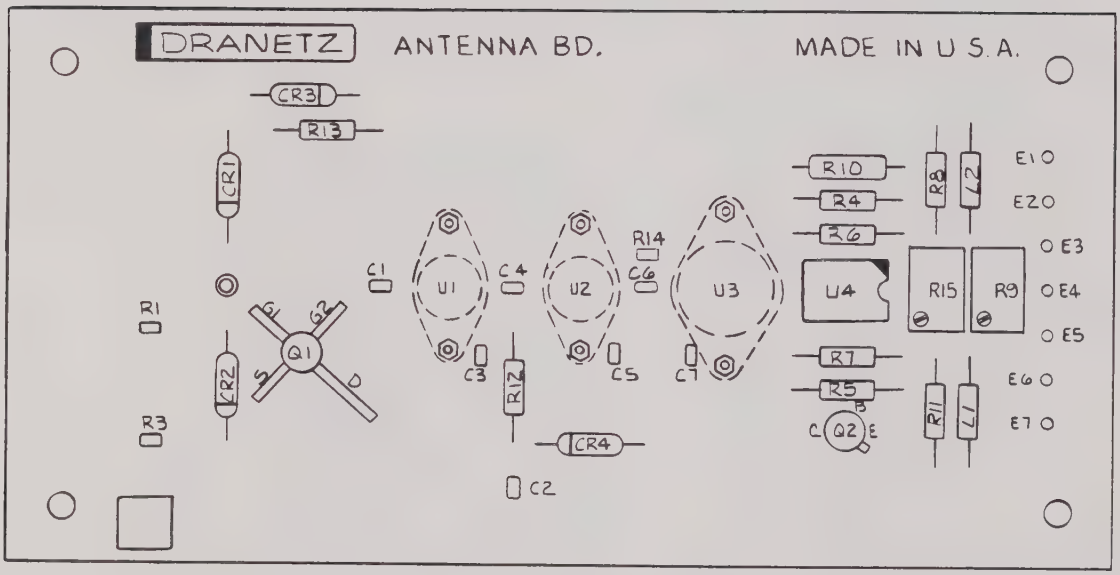

COMPONENT SIDE

Figure 7-3. Antenna Board Assembly
111934-G1 (rev B)

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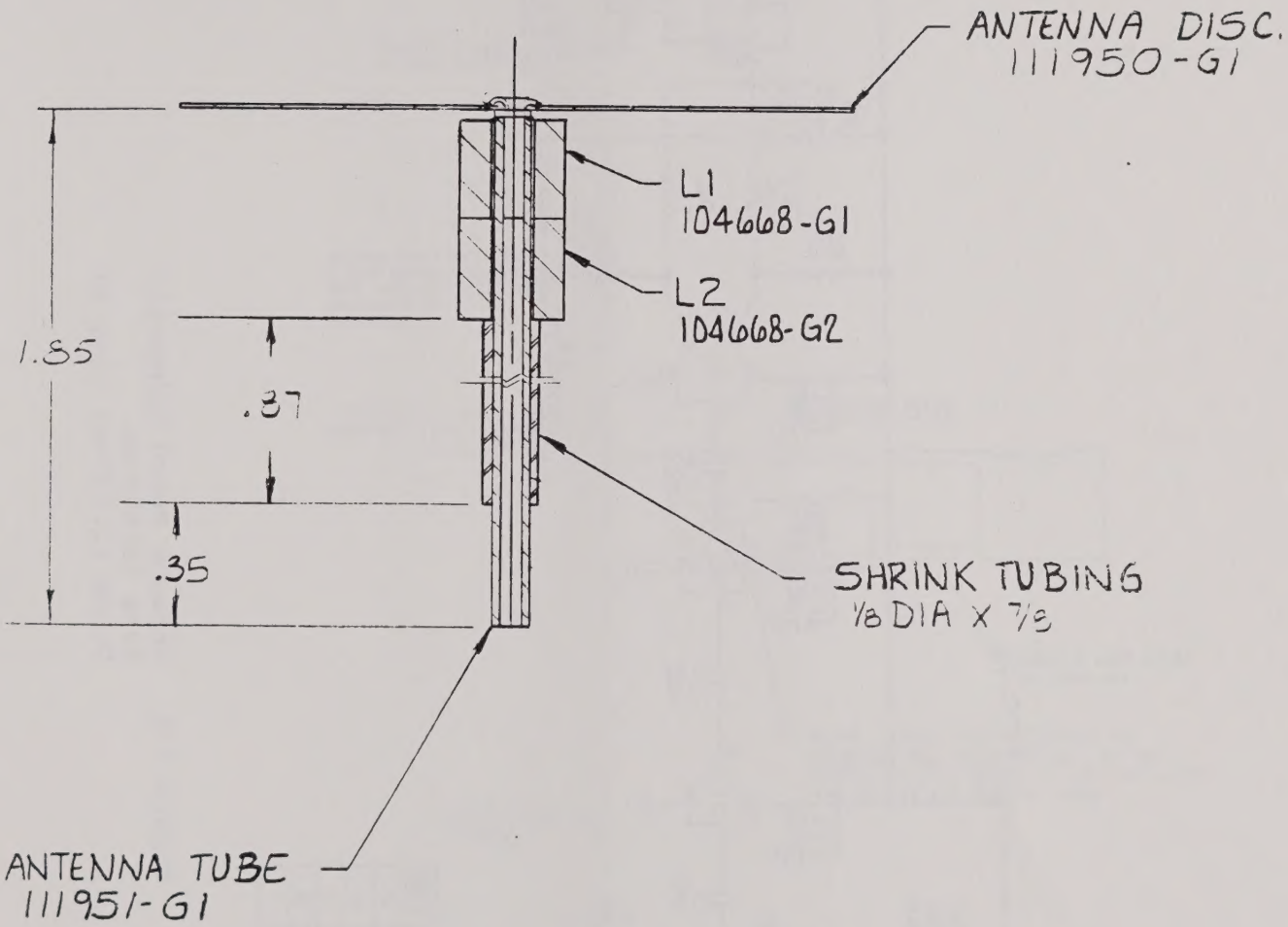

Figure 7-4. Antenna Assembly
111940-G1 (rev A)

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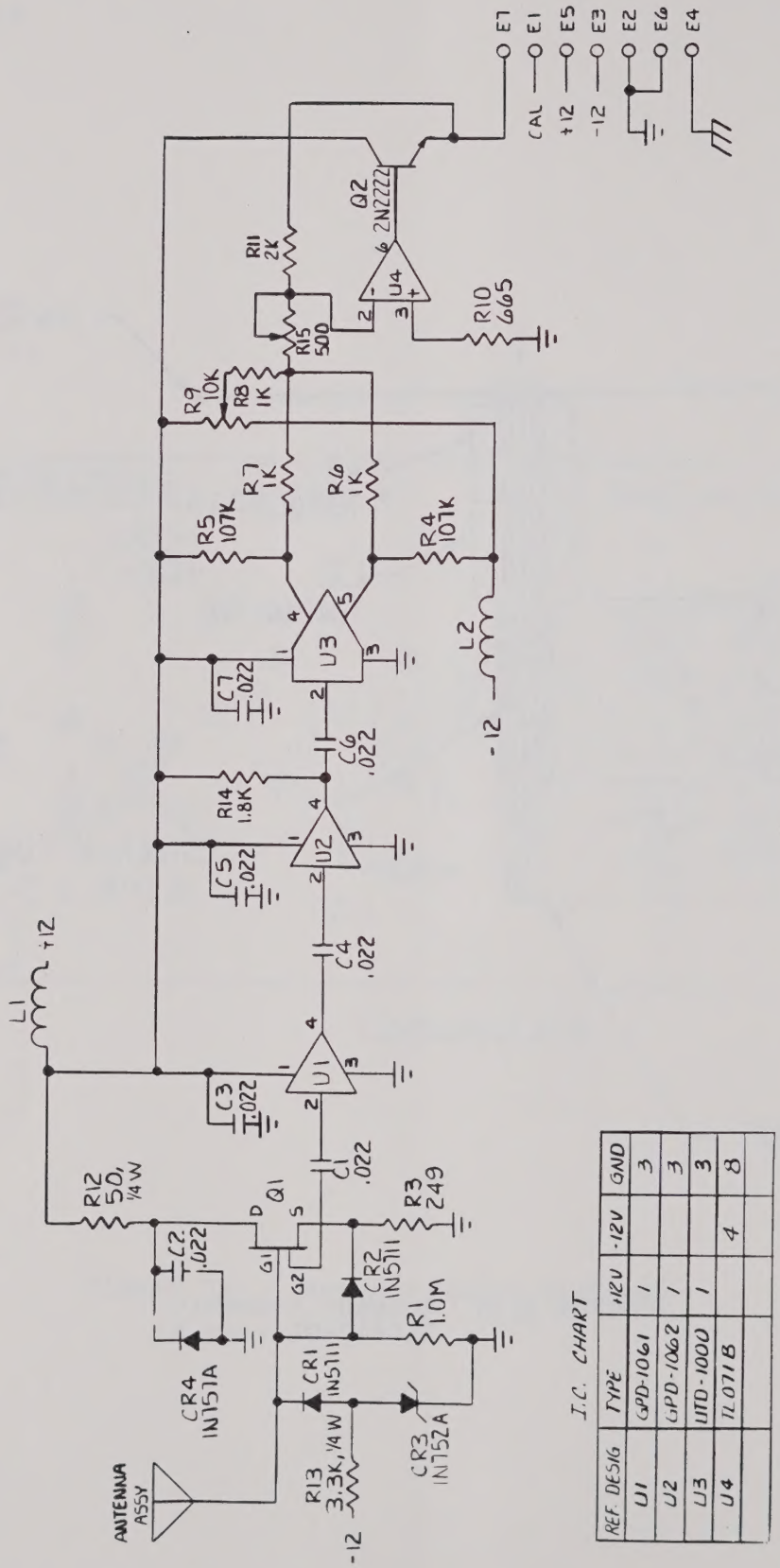

Figure 7-5. Antenna Board Schematic
Assy 111934-G1,
Schem 111939-G1 (rev B)

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DRANETZ SERVICE CORPORATION
Subsidiary of Dranetz Technologies, Inc.
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SOUTH PLAINFIELD, NJ 07080

TEL. (201) 755-7081
TWX: (710) 997-9553
TELEX: 499-7808
CABLE: DRANETZ

REPAIR/SERVICE ORDER

NOTE: THIS COMPLETED FORM MUST ACCOMPANY RETURNED EQUIPMENT

CUSTOMER SHIPPING & BILLING INFORMATION

CUSTOMER P.O. # _____ P.O. DATE _____

SHIP TO: _____ INVOICE TO: _____

_____ _____

_____ _____

_____ _____

In Continental U.S., material will be returned by Dranetz to you by UPS, UPS Blue or other carrier chosen by Dranetz unless otherwise designated.

EQUIPMENT BEING RETURNED

Date of Original Purchase: _____ Original P.O. # _____

Model No. _____ S/N _____

Model No. _____ S/N _____

Ancillary equipment also being returned (If you neglect this, these items may not be returned to you).

☐ Power & Other Cables _____ ☐ Instr. Book _____

☐ Plug-ins (incl. S/N) _____ ☐ Connectors _____

☐ Other _____

RETURN AUTHORIZATION

Have you discussed the problem with Dranetz Sales or Service personnel?

Dranetz Return Authorization # _____

By: _____

If so, with whom _____ Date: _____

Whom should the Dranetz Service Corporation contact for technical questions?

_____ ( )

NAME (Print) DEPARTMENT TELEPHONE

DESCRIPTION OF PROBLEM

Reason for return: Defective ☐ Calibration ☐

Please be detailed, explicit and complete. Include test data, if this helps to describe the problem.
IMPORTANT: Repairs cannot be made unless this section is completely filled out.
(Attach added sheets if necessary)

_____

_____

_____

_____

CHECK WHERE APPLICABLE: IS MALFUNCTION RELATED TO: Warmup ☐ Temperature ☐
Intermittency ☐ Mechanical Handling ☐ Visual Defects ☐ Grounding ☐ Test Data Attached ☐

INITIATOR OF THIS ORDER

_____

NAME/TITLE SIGNATURE TELEPHONE

(SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (ENCLOSE THIS ENTIRE FORM WITH EQUIPMENT)

IMPORTANT: FOLLOW INSTRUCTIONS & USE THIS FORM. IT IS DESIGNED TO HELP US HELP YOU.

1. **Before** returning equipment to our factory, call our Service Corporation **Tel:** (201) 755-7081
   Give the model No., serial number, and information on the problem.

   A. Our specialists may be able to solve your problem rapidly without equipment return.

   B. If equipment return is needed, you will be supplied with appropriate instructions and authorization information to expedite service.

2. If return is to be made,

   A. Fill out the other side of this form **COMPLETELY.**

   B. Enclose original of form INSIDE the shipping carton, preferably attached by masking tape to the equipment.

   C. Ship prepaid (including insurance); we will return prepaid unless otherwise advised by you.

   D. **IMPORTANT** - PACK PROPERLY! SHIPPING DAMAGE WILL BE CHARGED TO YOU!

NOTE: NEW EQUIPMENT

Statement of Warranty - All products of Dranetz Technologies, Inc. are warranted to the original purchaser against defective material and workmanship for a period of one year from the date of delivery. Dranetz will repair or replace, at its option, all defective equipment returned, freight prepaid, during the warranty period, without charge for repair, provided there is no evidence that the equipment has been mishandled or abused.

FILL OUT OPPOSITE SIDE OF THIS FORM AND RETURN WITH EQUIPMENT.